

1/PRTS

531 Rec'd PCT

0/018456

12 DEC 2001

Transl. of PCT/EP00/05840

## [T R A N S L A T I O N]

SELF-SEALING COMPACT SPINNERET FOR THE MELT SPINNING PROCESS

## DESCRIPTION:

The invention relates to a spinneret for the spinning of thermoplastics having a central polymer melt inlet passage, a filter arrangement comprised of one or more filter disks of different filter finenesses [filter grades], a spinneret plate and a housing close-fitting around and receiving the filter arrangement and the spinneret plate.

Pressure build-up, shear and filtering of the polymer to be spun in a spinneret are usually accomplished by means of a sand filling as is described for example in U.S. Patent 5,304,052 or U.S. Patent 5,795,595. These sand fillings, whether of steel grit or pure quartz sand, are however associated with various drawbacks:

15 for one, the sand fillings themselves are not identical from spinneret to spinneret even when prepared with the greatest of care and for another there are handling difficulties with respect to filling with sand and the transport of the filled spinnerets. Apart from this, discrete sand grains can render the internal seals

20 of the spinnerets ineffective. These seals formed during the incorporation of the sieve filter, form first of all overflows

10016456-121201

because of their U shape and also small dead zones, i.e. in the U shaped configurations, exchange is rendered difficult and can result in a decomposition of the polymer. There is also a cost factor. Each component contributes to cost and seals are the origin of ongoing operating costs since they can be used only once and with each nozzle replacement must be renewed. In addition they can provide no absolutely reliable seal as is known in practice since fabrication and mounting defects invariably increase with increasing numbers of the individual parts.

To alleviate some of the drawbacks associated with sand fillings it has been proposed to provide a filter construction as is known for example from DE 29 26 533 C2. Thus a method has been provided in which the individual filter disks are cold-pressed together so that a substantially better filter effect is produced than is the case with an identical arrangement with loose filter disks. Such cold-sintered filters are provided with a sealing enclosure and are supplied by various suppliers under commercial names like "Porostar" or Multipor". The sealing enclosure can suppress the aforementioned drawbacks.

The object of the present invention is to provide a spinneret for the spinning of thermoplastics which avoids the aforementioned drawbacks both from the point of view of sand fillings as well as the sealing enclosures. As a result the spinneret should have a configuration that is as compact as possible. The solution to these objects is achieved according to

the invention with a spinneret according to the features of the patent claims.

According to the invention, filter structures of filter disks cold-pressed against one another are used but without the conventional sealing housing by providing them in a housing bore which matches them as precisely as is possible [press fit] whereby the material of the filters should have a substantially higher coefficient of thermal expansion than the material of the housing. The sealing of the filter structure is effected at the operating temperature by thermal expansion and with the spinneret plate in an optional manner.

Further it is proposed to fabricate the spinneret plate out of a material with a high coefficient of thermal expansion and to insert it into a bore in the housing which receives it in as close to a matching fit [press fit] as is possible. In this case the sealing of the spinneret plate is effected at the operating temperature by thermal expansion. The filter arrangement can be constructed in an optional manner and can be fabricated from a material with an optional coefficient of thermal expansion.

Preferably the filters of the filter disks cold-pressed together as well as the spinneret plates are composed of materials of high coefficients of thermal expansion and both parts are inserted in bores with press fits in a housing fabricated from a material with a lesser coefficient of thermal expansion.

Preferably the spinneret plate is additionally provided with a thread in its lower half and directly screwed into the

housing so as to obtain the tight fit sealing seat described previously, the thread and the abutment of the spinneret in the housing being so formed that the spinning hole pattern is always in <sup>same</sup> the spinning hole pattern is always in the same orientation. This  
5 ensures that by screwing it in to its abutment [or stop], the correct blowing onto the filaments as they are spun out is effected.

Preferably the housing at its lower end is provided with a projecting collar which has at least three grooves for receiving a tool for screwing the spinning system in or out and which protects the spinneret against detrimental contact during the handling.

The filter unit according to the invention avoids the drawbacks of classical sand filtration. The elimination of the conventional sealing results in a significant cost saving and enhanced sealing reliability. By the suitable choice of materials and tolerance of fit of the individual parts of the spinneret according to the invention, the sealing effect is brought about at the operating temperature by the increased expansion of the inner  
20 components, namely the filter and/or the spinneret plate, with respect to the outer lying housing, without the requirement for additional elements. Further the short and compact construction is advantageous: cost effective fabrication and easier handling with more uniform and identical filtration from nozzle to nozzle.

25 The detailed description of a preferred embodiment of the invention follows in connection with FIG. 1 which shows an

illustration of a spinneret arrangement according to the invention by way of example: In a housing 1, a cold-sintered filter 2 is disposed, whose construction comprises individual layers of filter disks of different filter fineness, specifically selected for the particular spinning process, on a spinneret plate 3. In this exemplary spinneret arrangement, the spinneret plate 3 is fastened by means of a thread in the housing 1. This thread in the housing 1 and on the spinneret plate 3, are thus so configured that upon screwing of the plate in until it reaches an abutment [stop] the spinning orifice pattern is always located at the same place so that the correct blowing onto the filaments as they are spun out of the orifices can be assured. The connection of the polymer melt supply is effected via the connecting seal 4 and adapter (not here further shown) to the heating vessel (also called the spinning beam). The embodiment can be matched completely to the requirements of the user and the equipment available to him.

The housing 1 is comprised of material No. 1.4057 (according to German Industrial Standard - Steel Key), a material with a relatively low thermal expansion coefficient. The spinneret plate 3 can be composed of material No. 1.4580 and the filter structure 2 of material No. 1.4301 or 1.4541, all materials with a relatively high coefficient of thermal expansion. The fits are so selected with respect to the dimensions and materials that the individual parts, in a cold state can easily be fitted together and disassembled from one another and that the sealing effect on the one hand will result at the latest shortly before the specific

spinning temperature is reached and on the other hand the parts at elevated cleaning temperature (about 450 - 540°C) will not be damaged by overexpansion.

1001056-12121  
5 The desired self-sealing function in the operating state is achieved without conventional seals by the targeted pairing of materials and selection of the fits: the four parts, housing 1, filter 2, spinneret plate 3 and connection seal 4 are mounted together in the cold state and thereafter heated as is customary. Because of the different thermal expansions, the sealing effect arises and the spinneret can spin the filaments at optional pressure. The outer housing 1 is thus comprised of material of a relatively low coefficient of thermal expansion and the inner parts, filter 2 and/or spinneret plate 3 can be fabricated by contrast of a material with a higher thermal expansion coefficient. The dimensions are so selected that the parts can easily be mounted in the cold state (room temperature) but at the operating temperature for spinning (about 300°C) because of the differential expansion can yield a self-sealing press fit between the parts. Upon termination of spinning, the complete spinneret is subjected  
20 to a cleaning and first after cooling is disassembled. Thereafter, the spinneret plate 3 and the filter element 2 which can thus be used primarily like a filter candle, can be further cleaned and scraped or subjected to ultrasound.

25 The sealing principle here expounded upon using differential thermal expansion is not limited to the described spinnerets and filter uses but can be used universally wherever

filtering, shearing or spinning is desired whether for microfibers, textile filaments, high strength tire cords or other applications. It remains for the product or applications expert to select the configuration by the choice of the cold-sintered filter, the materials and the fits for their special cases either by analysis or empirically.

Reference character list:

1. Housing
2. Filter structure, filter
3. Spinneret plate, nozzle plate
4. Connection seal